Patent Claims

1. Method of attaching a functional element (10, 210), in particular a fastener element to a sheet metal part (12, 212), optionally in liquid and/or gas-tight manner,
characterized in that
the functional element (10, 210, 410) is pressed against the sheet metal part (12, 210, 410) supported by a die (14, 114, 214, 414) and sheet metal material (13) is pressed by means of at least one movably mounted shaped part (16, 116, 216, 416) of the die (14, 114, 214, 414) into an undercut (18, 218, 418) of the functional element (10, 210, 410).

2. Method in accordance with claim 1,
characterized in that
the sheet metal material (13) is brought by means of the shaped part (16, 116) into engagement with in particular groove and/or rib-like features (21) providing security against rotation formed on the functional element (10).

3. Method in accordance with claim 1,
characterized in that
the sheet metal material (13) is first pressed into the undercut (18, 218, 418) and preferably brought into engagement with the features (21) providing security against rotation after the sheet metal part (12, 212, 412) has been at least partly shaped by the movement of the functional element (10, 210, 410) in the direction of a longitudinal axis (22, 122, 222, 422) of the die (14, 114, 214, 414)

for the attachment to the sheet metal part and has in particular been provided with an approximately collar-like or pot-like recess.

4. Method in accordance with claim 1, characterized in that the sheet metal part (12, 212) is not perforated or holed, at least in the region of the functional element (10, 210, 410) on its attachment to the sheet metal part (12, 212).

5. Method in accordance with claim 1, characterized in that a pre-holed sheet metal part (412) is used or in that the sheet metal part is holed during the attachment of the functional element by means of a self-piercing functional element or of a preceding hole punch.

6. Method in accordance with claim 1, characterized in that the shaped part (16, 116, 216, 416) is moved by means of the functional element (10, 210, 410) moved in the direction of a longitudinal axis (22, 122, 222, 422) of the die for the attachment to the sheet metal part (12, 212, 412).

7. Method in accordance with claim 1, characterized in that at least one engagement section (20, 120, 220) of the shaped part (16, 116, 216, 416) is moved with a radial component perpendicular to a longitudinal axis (22, 122, 222, 422) of the die (14, 114, 214, 414) for the pressing of the sheet metal material (13) into the undercut (18, 218, 418).

8. Method in accordance with claim 1,
characterized in that
the shaped part (16) is rotated about an axis of rotation (24) extending preferably approximately perpendicular to a longitudinal axis (22) of the die button (14).

9. Method in accordance with claim 1,
characterized in that
the shaped part (116, 216, 416) is moved along a shaped surface (26, 226, 426) which converges towards a longitudinal axis (112, 222, 422) of the die (114, 214, 414) in the direction of movement of the functional element (10, 210, 410) during its attachment to the sheet metal part (12, 212, 412).

10. Method in accordance with claim 1,
characterized in that
the shaped part (16, 216, 416) is shifted approximately perpendicular to a longitudinal axis (122, 222, 422) of the die.

11. Method in accordance with claim 1,
characterized in that
the shaped part (16, 116, 216, 416) is moved against a force counteracting the movement of the functional element (10, 210, 410) in the direction of a longitudinal axis (22, 122, 222, 422) of the die (14, 114, 214, 414), in particular against the resetting force of an elastically deformable support element (28, 128, 228, 428) for the shaped part (16, 116, 216, 416).

12. Method in accordance with claim 1,
characterized in that
when using a sheet metal part (12, 212, 412) having a coated surface, this surface is not damaged, at least at the side lying opposite to the functional element (10).

13. Die (14, 114, 214, 414), in particular for use in a method in accordance with claim 1 having at least one movably mounted shaped part (16, 116, 216, 416) which is formed for the pressing of sheet metal material (13) into an undercut (18, 218, 418) of a functional element (10, 210, 410), in particular a fastener element, which is to be attached, in particular in liquid and/or gas-tight manner, to a sheet metal part (12, 212, 412).

14. Die in accordance with claim 13,
characterized in that
the shaped part (16, 116, 216, 416) bounds a forming space (30, 130, 230, 430) at least regionally, especially a somewhat pot-like forming space (30, 130, 230. 430) into which the functional element (10, 210, 410) and especially a head part (10a, 210a, 410a) of the functional element (10, 210, 410) can be introduced for the reshaping of the sheet metal part (12, 212, 412).

15. Die in accordance with claim 13,
characterized in that
the shaped part (16, 116, 216, 416) is movable against the resetting force of a support element (28, 128, 228, 428).

16. Die in accordance with claim 13,

characterized in that
the shaped part (16) is formed as a rotatably mounted lever with an engagement arm (16a) which preferably has an engagement section (20) in the region of its free end for the pressing of sheet metal material (13) into the undercut (18) of the functional element (10) and is formed with an actuating arm (16b) which is directly or indirectly loadable by the functional element (10).

17. Die in accordance with claim 16,
characterized in that
the engagement arm (16a) and the actuating arm (16b) include an approximately right-angled angle.

18. Die in accordance with claim 16,
characterized in that
the actuating arm (16b) extends approximately perpendicular to a longitudinal axis (22) of the die (14) and at least regionally forms a floor section of a shaping space (30), with the shaped part (16) preferably being at least substantially right-angled or L-shaped in side view and being formed with a shape resembling a segment of a circle with an acute segment angle in plan view.

19. Die in accordance with claim 16,
characterized in that
the engagement arm (16a) extends at least parallel to a longitudinal axis (22) of the die (14) and at least regionally forms a side wall section of a shaping space (30).

20. Die in accordance with claim 16,

characterized in that
the engagement section of the engagement arm (16a) lies approximately at the level of a support surface (32) of the die (14) for the sheet metal part (12) and is preferably formed as a projection (20) which points at least approximately in the direction of a longitudinal axis (22) of the die (14).

21. Die in accordance with claim 16,
characterized in that
the axis of rotation (24) of the shaped part (16) lies in a plane extending perpendicular to a longitudinal axis (22) of the die (14) and through the transition region between the engagement arm (16a) and the actuating arm (16b) and has a radial spacing from the longitudinal axis (22).

22. Die in accordance with claim 16,
characterized in that
the shaped part (16) is at least substantially non-displaceably supported in the region of its axis of rotation (24) in the direction of a longitudinal axis (22) of the die (14), for example in that a stub axle (49) is provided on both sides of each shaped part (16) in the transition region between the engagement arm (16a) and the actuating arm (16 b) and the stub axles are pivotally journalled in bearing mounts (51) which are formed between the body (40) of the die (14) and a cover plate (53).

23. Die in accordance with claim 16,
characterized in that

the actuating arm (16b) is supported at least in the region of its free end facing the longitudinal axis (22) of the die (14) on an elastically deformable support element (28).

24. Die in accordance with claim 13,
characterized in that
an outer surface (17a, 217a, 417a) of the shaped part (116, 216, 416), especially an outer surface facing away from the longitudinal axis (122, 222, 422) of the die (114, 214, 414) is movable along a shaped surface (26, 226, 426) of the die (114, 214, 414) which extends in the direction of movement of a functional element (10, 210, 410) during its attachment to the sheet metal part (12, 212, 412) towards the longitudinal axis (122, 222, 422) of the die (114, 214, 414) and preferably extends approximately parallel to the outer surface (17a, 217a, 417a) of the shaped part (116, 216, 416).

25. Die in accordance with claim 24,
characterized in that
an inner surface (17b, 217b, 417b) of the shaped part (116, 216, 416) extending preferably approximately parallel to a longitudinal axis (122, 222, 422) of the die (114, 214, 414) and facing the longitudinal axis (122, 222, 422) of the die (114, 214, 414) is movable against a preferably somewhat cylindrical abutment element (34, 234, 434) of the die (114, 214, 414), the longitudinal axis of which coincides with the longitudinal axis (122, 222, 422) of the die (114, 214, 416).

26. Die in accordance with claim 24,
characterized in that

the shaped part (116, 216, 416) is supported on an elastically deformable support element (128, 228, 428).

27. Die in accordance with claim 13,
characterized in that
a plurality of movably mounted and preferably identically designed shaped parts (16, 116, 216, 416), preferably from two to eight and especially three or six such movably mounted shaped parts are arranged distributed about a longitudinal axis (22,122, 222, 422) of the die (14, 114, 214, 414) and preferably uniformly distributed around it.

28. Die in accordance with claim 13,
characterized in that
the or each shaped part (16, 116, 216, 416) has at least approximately the cross-section of an equilateral triangle in a plane extending perpendicular to a longitudinal axis (22, 122, 222, 422) of the die (14, 114, 214, 414) with the shaped parts (16, 116, 216, 416) preferably being arranged in the manner of pieces of cake around longitudinal axis (22, 122, 222, 422) of the die (14, 114, 214, 414), especially around an abutment element (34, 234, 434) of the die (114, 214, 414).

29. Die in accordance with claim 13,
characterized in that
the or each shaped part (16, 116, 216, 416) is exchangeably designed.

30. Die in accordance with claim 25,
characterized in that

the abutment element (234, 434) has a ring shoulder (280, 480) contacted by the shaped parts (216, 416) at their ends (278, 478) remote from the shaping space (230, 430) and in that an elastic resetting element (228, 428) biases the abutment element (234, 434) and, via the ring shoulder (280, 480), the shaped part (216, 416) in the direction of an open position of the die (214, 414).

31. Die in accordance with claim 30,
characterized in that
the force of the elastic resetting element (228, 428) is so selected that the shaped parts (216, 416) can first be moved out of the open position of the die along the shaped surface (226, 426) of the die when an end face of a setting device (310, 410) which presses the functional element (310, 410) downwardly clamps the sheet metal part (212, 414) between itself and the shaped parts (216, 416).

32. Die in accordance with claim 30,
characterized in that
the shaped parts (216, 416) have respective cut-outs extending in the longitudinal direction of the die (214, 414) into which pins (286, 486) fixedly arrange in the outer wall of the die project and define the open position of the die (214, 414) in that they restrict the movement of the shaped part into the opened positions.

33. Die in accordance with claim 32,
characterized in that
the axial length of the cut-outs (288, 488) less the axial height of the pins (286, 486) corresponds at least substantially to the maximum

stroke provided for the shaped parts (216, 416) in the axial direction of the die (214, 414).

34. Die in accordance with claim 32,
characterized in that
the width of the cut-outs (288, 488) perpendicular to their axial direction corresponds to the diameter of the pins (286, 486) entering into them.

35. Die in accordance with claim 24,
characterized in that
the shaped parts (116) have an inclined shaped groove (119) in their respective radially outwardly facing side, with the shaped groove sliding on a guide prism of complementary shape which is arranged in the body (140b) of the die (114), with the correspondingly inclined surfaces of the prisms (117) converging in the direction towards the longitudinal axis (122) moving away from the sheet metal part.

36. Functional element, in particular fastener element for the particular liquid and/or gas-tight attachment to a sheet metal part (12) in accordance with a method in accordance with claim 1 and/or using a die (14, 114) in accordance with claim 13, the element having an undercut (18, 218, 418).

37. Functional element in accordance with claim 36,
characterized in that
the undercut (18, 218, 418) has the shape of a surface region converging obliquely towards a longitudinal axis (36).

38. Functional element in accordance with claim 36, characterized in that the undercut (18, 218) has the form of a surface region of a head part (10a, 210a) preferably having an at least approximately circular cross-section and tapering in the direction of a shaft part (10b, 210b) and is formed on a shaft part (10b, 210b) and/or in the region of the transition between a head part (10a, 210a) and a shaft part (10b, 210b).

39. Functional element in accordance with claim 36, characterized in that it is provided with features providing security against rotation, in particular groove and/or rib-like features for attachment to the sheet metal part (12) in a manner secure against rotation, the features providing security against rotation including at least one and preferably a plurality of cut-outs (21) formed in a peripheral wall and preferably arranged uniformly distributed about a longitudinal axis (36).

40. Functional element in accordance with claim 36, characterized in that it is formed as a threaded pin, in particular a threaded pin formed in a rolling process, the pin preferably having a substantially constant outer diameter and being connected to the sheet metal part in the region of the thread with one or more thread turns forming the undercut.

41. Functional element in accordance with claim 40, characterized in that

it is provided at its lower side which confronts the sheet metal part (12) in the attached state with features (21) providing security against rotation and are in particular arranged eccentrically relative to its longitudinal axis (36), preferably in the form of one or more recesses and/or raised portions.

42. Functional element in accordance with claim 40, characterized in that
it is provided at its peripheral wall with features (21) providing security against rotation and which in particular interrupt a thread (11), preferably features in the form of one or more recesses and/or raised portions.

43. Component assembly comprising at least one sheet metal part (12, 212, 412) at least one functional element (10, 210) in accordance with claim 36, which is manufactured in accordance with a method in accordance with claim 1 and/or using a die (14, 114, 214, 414) in accordance with claim 13, with the functional element (10, 210, 410) being connected or hooked in substantially form-fitted manner to the sheet metal part (12, 212, 412) in the region of an undercut (18, 218, 418) of the functional element (10, 210, 410) by a technical shaping and joining method.

44. Component assembly in accordance with claim 43, characterized in that
the sheet metal part (12, 212, 412) is not perforated or is not holed at least in the region of a functional element (10, 210, 410) or in the region of a connection to the functional element (10, 210, 410).

45. Component assembly in accordance with claim 43, characterized in that when using a sheet metal part (12, 212, 412) having a coated surface this surface is not damaged, at least at the side opposite to the functional element by the attachment of the functional element (10) to the sheet metal part (12).

46. Component assembly in accordance with claim 43, characterized in that the functional element (10, 210, 410), and in particular a head part (10a, 210a, 410a) of the functional element (10, 210, 410) is at least partly arranged in a pot-like recess of the sheet metal part (12, 212, 412).

47. Method of attaching a functional element (610) to a sheet metal part (612), characterized in that one first produces an inverted pot-like formation (613a) in the sheet metal part (612), presses the functional element (610) against the formation (613a) and the latter into a pot-like recess (634) of a die (614) and thereby converts the inverted pot-like formation (613a) into a pot-like formation (634) while the sheet metal material is brought intimately into contact against the outer side of an end of the functional element (610), optionally using a setting head (600) with a ring nose (645) arranged around the functional element, or noses arranged around the functional element which produces or produce in the sheet metal part a ring recess (649) around the functional element or individual recesses around the latter, with the

simultaneous shifting of sheet metal material radially towards the functional element.